

THURSDAY, JANUARY 14, 1909.

CONSTRUCTION AND USE OF CRANES.

Cranes: their Construction, Mechanical Equipment, and Working. By Anton Böttcher. Translated and supplemented with English, American, and Continental Practice by A. Tolhausen. Pp. xvii+510. (London: A. Constable and Co., Ltd., 1908.) Price 42s. net.

MODERN developments of means of transit, especially in the direction of the transhipment of heavy goods, have made it necessary that rapid and powerful lifting gear should be devised, and *pari passu* with the developments of heavy engines and wagons, heavy ordnance and large ocean liners, there has been an equally interesting and important advance in the construction of rapid and heavy cranes.

The book before us has for one of its aims the presentation of the progress that has been made, and with this end in view many types of cranes are described and discussed in detail, and illustrated by photographic views of general arrangements, together with dimensioned drawings of more than seventy particular examples.

The book is, however, by no means simply a descriptive work, as all parts of cranes that lend themselves to theoretical treatment are dealt with in a sound manner. The first part of the book deals with first principles in crane-building practice, and to those who have had a preliminary training in the elements of applied mechanics should be of interest and of great value in showing their applications to definite design problems, as well as for the immediate object in view. For example, the use of the funicular polygon in the resolution and composition of forces is illustrated, and the laws of motion are used to determine the time of motion, and the forces required to give momentum to the travelling portions of various forms of cranes. It also includes an interesting paragraph on "efficiencies," and, along with other valuable tables, one giving the efficiencies of crane parts. In the paragraph on struts only Euler's formulæ are given. This is to be regretted, as it is generally agreed in this country that more trustworthy results are obtained by such formulæ as Rankine's or Tetmajer's. Part ii. is devoted to the general arrangements of cranes, and opens with a concise summary of the local influences which decide the character of cranes in different circumstances, followed by general descriptions of many types, from the old-time hand winches to the most modern electric-driven travelling cranes.

Part iii. deals with crane-driving principles; driving by hand, shafting, steam, water and electricity are treated, and the principles involved in the determination of the power required to lift a given load at a given speed, and the gear ratios are dealt with in detail. The subject-matter of the hydraulic and electrical sections is particularly good, but the translation is not all that could be desired, as the meaning is at times somewhat obscure, especially in the electrical section, which, we fear, will hardly be intelligible

except to those very familiar with the theory and practice of motors. The translation is surely not happy when, in the hydraulic section, a sentence is rendered as "the rams beget larger diameters with equal lifts." In one or two cases the obscurity is intensified by slips in proof-reading, as, e.g., on p. 102; the velocity of the water through the valve is proportional to the difference of pressure in the valve box and cylinder, so that in the formula, p_0 should be replaced by $p_0 - p_1$. We were some time before we could put a meaning to the following, which opens the paragraph on speeding up electric motors:—"The current curves represented in Fig. 257—corresponding with full cut-off initial resistance to the inscribed circumferential moment—are independent," &c., and even now we are in doubt as to the author's meaning. It is also, we think, not usual to speak of the back E.M.F. of a continuous-current motor causing current lagging. In the paragraph on "running down" we were rather held up for the moment by "To hold the load in a fixed position the simple running down will suffice in many cases," until we realised that the translator meant that the switch is in the running-down position, and the mechanical friction of the gearing, &c., is sufficient to prevent the load running down.

We do not remember in English works to have met with the method used by the author of determining the ratio of the areas of the lifting rams and the valve openings of hydraulic cranes, by consideration of the difference between the velocity of lifting and lowering. The method, though simple and well known to some English designers, has not received the attention it deserves, and is well worth careful study by those engaged in this branch of designing.

Part iv. considers in a very complete manner crane parts and accessories, and designers of all classes of machinery will find the information given valuable. This is followed by a section devoted to the design and calculation of crane girders. The designs of riveted joints and of various forms of girders are considered in a very practical manner, and where theory fails current practice is referred to. A number of sound hints are given, as, for example, when the author is dealing with the stiffening of travelling girders, he remarks:—

"As practice alone can guide us in this respect, it is advisable, when such exigencies can be drawn upon to draft the design in such a manner that eventual stiffening may be resorted to if found to be requisite in testing or working."

The determination of the maximum stresses that can occur in the members of a lattice girder, due to the crab moving over the girders, is dealt with in a way that should appeal to those who are familiar only with the ordinary stress diagrams, the influence line being deduced from a number of diagrams drawn from a single load fixed at a different point for each of the diagrams. It is, we think, unfortunate that the very simple method of influence lines is not better known, as without the labour involved in drawing stress diagrams the unit load diagram or "influence line," for any member, in the top boom,

for example, can be at once drawn by erecting an ordinate at the junction of the diagonal of the same bay with the bottom boom, equal to the product of the two parts into which the junction point divides the span, and joining the end of the ordinate with the ends of the span. An equally simple construction gives the line for any member of the bottom boom, and the influence lines for all the diagonals can be drawn by first drawing two parallel lines through the ends of the span; then if verticals are drawn through the end points of any bay to meet these respective lines, and the two points of intersection are joined, the line thus drawn, together with the two parallel lines, is the "influence line" for the given bay.

Part vi. is devoted to the description of, and calculations for, types of German, English and American cranes. This part of the book is particularly valuable, as theory and practice supplement each other in a way that is really helpful to designers. The last three sections are devoted to specifications, useful tables, and a valuable index to articles and papers on cranes. The book is excellently printed and well illustrated on very stiff paper. It can cordially be recommended to designers, builders, and users of all kinds of lifting and carrying machinery, and we can hardly think of a branch of mechanical engineering in which the book will not prove useful for reference. Students will also be well repaid by a careful study of the designs given and the calculations therewith, as they will be able to appreciate, perhaps, better than in any other way, the limitations of the theories upon which they are apt to place implicit trust.

F. C. L.

AN OXFORD CHAMPION OF DARWINISM.

Essays on Evolution, 1889-1907. By Prof. E. B. Poulton, F.R.S. Pp. xlviii+480. (Oxford: Clarendon Press, 1908.) Price 12s. net.

ON July 1, 1858, an epoch in the history of science was created by the reading, before the Linnean Society of London, of the papers by Darwin and Wallace on natural selection; and on July 1, 1908, the fiftieth anniversary of this momentous occasion was appropriately celebrated under the auspices of the same society. The publication of Prof. Poulton's volume is especially well timed, for it appears while the Darwin-Wallace commemoration is fresh in the minds of all, and while the weighty utterances by which the veterans Wallace and Hooker themselves so greatly added to the interest of the proceedings on that occasion are still a recent memory.

Among those men of science who have found their chief inspiration in the work of Darwin and Wallace, no one has laboured with greater perseverance and success than Prof. Poulton, and the present collection of essays embodies the main results of his investigations during his tenure of the Hope chair at Oxford. The memoirs have all in one form or another appeared before, but the author is not by any means content with a mere reprint of his former publications; he has, on the contrary, spared no pains to bring the treatment of his various topics up to date, and a

comparison with the lectures and addresses in their original form will show that in many cases this must have involved considerable labour. But with so fertile and so rapidly growing a subject as that which Prof. Poulton has made his own, a period of nineteen years, which is that which separates the first essay in point of date from the present time, gives opportunity for enormous accessions of material, and almost inevitably involves some modification, if not in the principles, at least in the details of interpretation. The author has acted fairly towards his readers by ensuring that the essays here reprinted, though preserving the general form and tone in which they were originally framed, should nevertheless be the expression of his own present views, and should embody the principal points of evidence that have since come to light. The keynote of the book is the all-importance of natural selection, as propounded by Wallace and Darwin, in the interpretation of the past history and present condition of organic nature. The essays form a powerful reinforcement of what is properly and distinctively called the Darwinian theory of evolution, and should tend to reassure those weaker brethren who have allowed themselves to be persuaded or terrified into losing confidence in the work of the two great founders of rational evolutionary doctrine.

The greater number of Prof. Poulton's arguments and illustrations are naturally drawn from the wonderfully rich domain of insect bionomics. The way in which the great Oxford collection, so liberally established by Hope, and so assiduously tended by Westwood, has been made of late years to subserve the cause of scientific research and progress, especially in the unravelling of intricate problems of evolution, is one of the most remarkable features in the recent history of the University. The development of such studies in Oxford, of which the present volume is only one among many manifestations, should be a matter of cordial congratulation to the present Hope professor, on the part, not only of entomologists, but of all who take a rational interest in any department of biology.

Space would fail us in the attempt to give an adequate account of the contents of this stimulating book. A bare enumeration must suffice. First comes a discussion upon the age of the earth, comforting to those biologists who have been disturbed by certain physical calculations now in great measure abandoned. Next we have the question asked and answered, "What is a species?" Essays follow on the theories of evolution which rival or antagonise Darwin's, on the nature of heredity, and on the remarkable anticipation of Galton and Weismann by the anthropologist James Cowles Prichard. The Birmingham lecture on Huxley is of especial value, as it not only defines and accounts for the precise attitude of that great biologist towards the Darwinian theory, but also contains one of the most forcible and convincing pleas that we have yet seen for a more rational use in education of our present system of examinations. The three concluding essays, which show an immense command of facts, deal in a masterly manner with the fascinating subject of mimicry. They are especially remarkable as in-